

followed in 18 months by a spontaneous remission, is not forthcoming. Hidden lymphoma is considered unlikely in this case in view of the prolonged history and the absence of hepatosplenomegaly, lymphadenopathy and paraproteinemia (qualitative variant of the beta-2-M-globulin). This possibility has not been completely excluded, however. Variability in production of immunoglobulins as demonstrated in the present case has been observed in certain probable viral diseases: in primary atypical pneumonia, the so-called "Wasserman positive" pulmonary infiltration is attended by the evanescent appearance of "Wasserman" antibodies; in infectious mononucleosis there is heterophil antibody production.<sup>7</sup> In the present case, however, no evidence of disease other than that which could be directly attributed to the high titers of cold agglutinins was present. It is interesting to speculate on the possibility that the cold hemagglutinin titer decreased following withdrawal of the stimulus for its production—cold weather.

## Summary

A case of spontaneously resolving "cold agglutinin disease" is described in a 40-year-old man after 18 months of intermittent acrocyanosis, hemoglobinuria and severe chronic hemolytic anemia. The characteristics of the abnormal macroglobulins are delineated. The possible relationship to Waldenström's macroglobulinemia is discussed.

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# The Immediate Use of a Massive Direct Pedicle Graft for Extensive Injuries of the Forearm

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IN RECONSTRUCTIVE SURGERY, one of the major challenges is the immediate or delayed demand for massive replacement of tissue in extensive injuries of the forearm. The selection of a method of primary or staged reconstruction of such a defect requires sound surgical judgment. If the motor and sensory functions of the hand are to be preserved, the integrity of the forearm must be maintained and its potentially viable bones, tendons and nerve tissues protected. Of the techniques available, grafting of a direct lower chest-upper abdominal pedicle is generally the preferred means of reconstructing a compound defect. If primary pedicle grafting is impossible, split-skin grafting or open management for drainage are alternate methods. Because a split-skin graft is dependent on the recipient area for its revascularization, it is not usually as satisfactory for reconstruction of a compound defect as is a pedicle graft.

The pedicle is a composite of skin and subcutaneous tissue supported by a lifeline supply of blood at its base during attachment. The recipient area will ultimately provide collateral circulation that will sustain the transferred tissue after division of its base. During transfer of the pedicle the peripheral and deeper plane collateral blood vessels will have been divided to mobilize the tissue for transfer. Since the base of the pedicle will have to support the length of the graft, the length should not be more than two and a half times the width of the base, since greater lengths potentially would be embarrassed by inadequate circulation.<sup>1</sup>

In each case, once the plan of approach is established, several basic steps must be taken before the operation can be executed with the maximum chance of success and preservation of tissue for permanent repair.

- Debridement and preparation of a healthy recipient bed.

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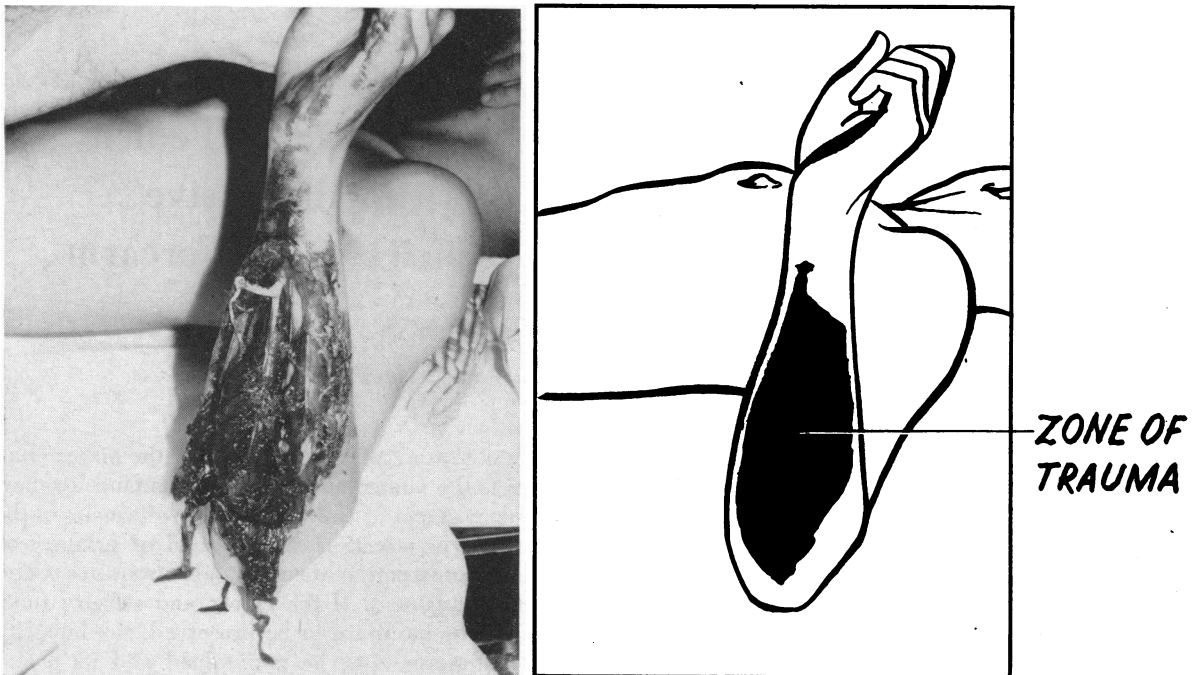


Figure 1.—Forearm wound caused by shotgun blast. Picture was taken after the wound was cleansed but before repair was begun.

- Consideration of the size of the local defect and the status of the circulation locally and distal to the defect.
- Measurement of pedicle tissue needed for reconstruction and proper orientation of the base of the pedicle for maximum use of tissue and maintenance of blood supply.
- Reconstruction of the defect at the donor site to eliminate open wounds.

The status of the circulation and the extent of functional deficit distal to the defect are of major importance. In all injuries of the forearm, the hand will provide the answer to the extent of functional deficit coexisting with the forearm injury since the three major nerves (ulnar, median and radial) can be partially or completely involved as can the extrinsic hand muscles and supporting bony architecture. Temperature, color, the presence of distal pulses, sensation and motor function of the hand must all be considered in a baseline evaluation. If, after initial evaluation, decision is made to reconstruct the tissues in the forearm, the basic plan is drawn. Debridement and preparation of the zone of trauma for proper reception of the pedicle graft are carried out. Matching the defect with an appropriate amount of pedicle tissue and incorporating in the plan enough tissue for orientation of the base and maintenance of the blood supply are essential to insure a proper pedicle transfer. Because the forearm is essentially cylindrical, the base of a direct pedicle graft

may be above or below the forearm depending upon the mechanical advantage offered—that is, a superiorly-based pedicle for a defect of the radial aspect and an inferiorly-based pedicle for a defect of the ulnar aspect. A donor site should be selected for a dermatome split-thickness skin graft that will be used to reconstruct the defect on the torso created by transferring the direct pedicle.

### Report of a Case

A 17-year-old boy was leaving a boat when a shotgun that he was holding by the muzzle was accidentally discharged. The blast, obliquely directed at close range to the ulnar aspect of his forearm tore away skin, subcutaneous tissue, fascia and muscle, and stripped the periosteum of the central one third of the ulna without fracturing the bone (Figure 1). Many pellets of birdshot were implanted in the soft tissue of the forearm and upper arm without causing brisk arterial bleeding. Clinical shock was absent. The hand was warm and sensation was intact over the distribution of the median and radial nerves but was slightly impaired over the distribution of the ulnar nerve. The patient could flex and extend the fingers, but individual sublimus, profundus and intrinsic motions were difficult to assess because of the traumatic involvement of the soft tissue and the pain associated with motion.

Under general anesthesia, the wound was cleansed with a half-and-half solution of liquid soap and hy-

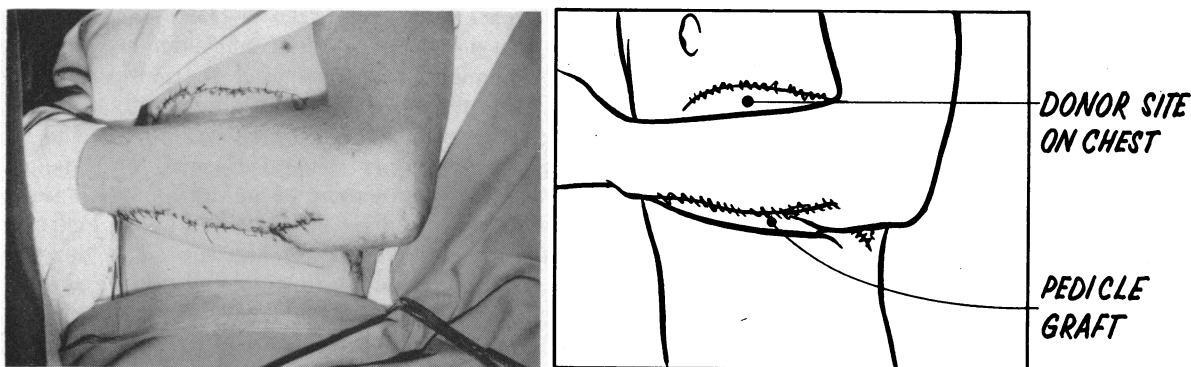


Figure 2.—Showing placement of forearm and attachment of pedicle graft.

drogen peroxide, then with alcohol, ether and copious irrigation with normal saline solution. Excision of marginal wounds and of all devitalized tissue (including flexors of the little finger) provided a good recipient bed for a pedicle graft. The ulnar nerve was exposed from elbow to wrist and was seen to be intact although there was extensive ecchymosis of perineural tissue throughout its length. The size of the defect was appraised and a massive lower chest-upper abdominal, inferiorly-based pedicle was prepared. The left thigh was selected as a donor site for the split-skin graft that would be used to reconstruct the defect at the pedicle donor site creating a closed wound in that area (Figure 2). Plaster of Paris splints and rigging were employed for immobilization of the upper extremity to permit proper healing of the transferred pedicle with drainage point dependently designed for the elbow region at a junctional zone between the transferred pedicle, split-skin graft and skin of the forearm. Color, warmth and integrity of the distal pedicle and adjacent skin on the forearm were observed throughout the postoperative period. At the end of three weeks, sufficient pedicle was carried by the forearm and transection-division of the pedicle and staged reconstruction of the forearm were accomplished.

The patient left the hospital four weeks following the injury with all wounds healed. Tentative plans were made for possible transfer of a tendon to the little finger at a later date. Six weeks after injury, healing was stable and the integrity of the forearm had been preserved by the pedicle graft (Figure 3).

### Summary

The use of a massive direct, lower-chest pedicle graft in reconstructive operations on the forearm is outlined with presentation of a case. In planning primary or staged reconstruction procedures on the forearm, all efforts must be directed toward maintenance of maximum motor and sensory function of the hand.

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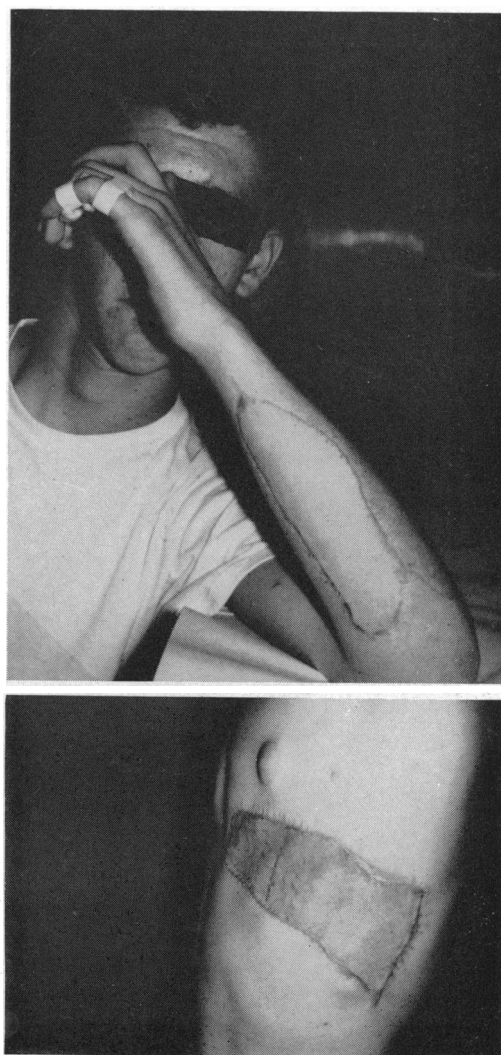


Figure 3.—Showing grafted area on forearm after healing, and pedicle donor site on chest and abdomen as repaired by split skin graft from thigh.